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SPRUCE BUDWORM
CONTROL PLAN FOR 1953
IN
OREGON AND WASHINGTON

Prepared by

NORTHWEST FOREST PEST ACTION COMMITTEE

Portland, Oregon
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TABLE OF CONTENTS

	Page No.
Introduction.	1
Current Situation	2
Recommendations for 1953.	6
Units to be treated in 1953.	6
Apportionment of Costs	7
Project Administration	8
Research	8
Control Unit Data	9
Western Oregon Area.	9
Blue Mountains-Oregon Area	10
Units Excluded from Control in 1953	12
Graph 1 - Progress of Spruce Budworm Epidemic	3
Table 1 - Summary of Spruce Budworm Situation	13
Table 2 - Proposed Control Project by Ownerships and Areas	14
Table 3 - Proposed Apportionment of Costs	15
Table 4 - Proposed Project Administration	16
Map Showing Status of Control Program by Units. . . .	17

SPRUCE BUDWORM CONTROL PLAN FOR 1953 IN OREGON AND WASHINGTON

INTRODUCTION

The following plan for the control of the spruce budworm in Oregon and Washington in 1953 is submitted by the Northwest Forest Pest Action Committee[1] after a careful analysis of survey findings in 1952. This plan calls for a continuation of the cooperative program begun in 1949 to prevent widespread tree killing by the spruce budworm.

The Committee has considered a recommendation that all the remaining epidemic infestation be treated. Desirable though it would be to get the job over once and for all, the Committee is convinced that it is impossible to blot out the epidemic by chemical means. Complete control can be effected only with the aid of nature. Furthermore, the timber values on some infested areas are too low to warrant spraying. Therefore, the Committee endorses the continuation of the policy of keeping the control program to a minimum by spraying only to prevent serious losses on heavily infested areas of economic importance and to protect previously sprayed areas.

1/ The Northwest Forest Pest Action Committee is composed of representatives of the following organizations:

Oregon State Board of Forestry
Keep Oregon Green Association
Tree Farm Management Service of Oregon
Oregon Extension Service
Associated Forest Industries of Oregon
Washington State Div. of Forestry
Keep Washington Green Association
Farm Bureau of Washington
Washington Forest Fire Association

Industrial Forestry Association
Western Pine Association
Western Forest Industries Association
U. S. Forest Service
U. S. Indian Service
U. S. Bureau of Plant Industry
U. S. Bureau of Land Management
U. S. Bureau of Entomology and Plant Quarantine

CURRENT SITUATION

The status of the spruce budworm in Oregon and Washington, as revealed by the survey of 1952 1/, is summarized in Table 1 on page 13.

Much has been accomplished in protecting the fir forests of Oregon and Washington from destruction by the spruce budworm. Four cooperative aerial spraying projects in 1949, 1950, 1951 and 1952, as recommended by the Committee, have controlled the budworm in the most critical areas of infestation. The progress of the budworm epidemic and the efforts to control it are shown in Graph 1 on page 3. The major accomplishments of the program are as follows:

(1) A total of 2,792,000 acres of epidemic infestation have been treated at a cost of approximately $3,000,000, or about $1.07 per acre.

(2) The acreage of completely dead timber, resulting from budworm defoliation, has been kept to approximately 9,000 acres.

(3) The budworm has been kept from causing any appreciable damage in western Oregon. In that area in 1952 the budworm was reduced to its lowest point in five years.

(4) Epidemic infestations apparently have been eliminated from the eastern Oregon Cascades area.

(5) Budworm populations on most of the treated areas continue to be low; however, a few small spots have become reinfested and some retreating is needed.

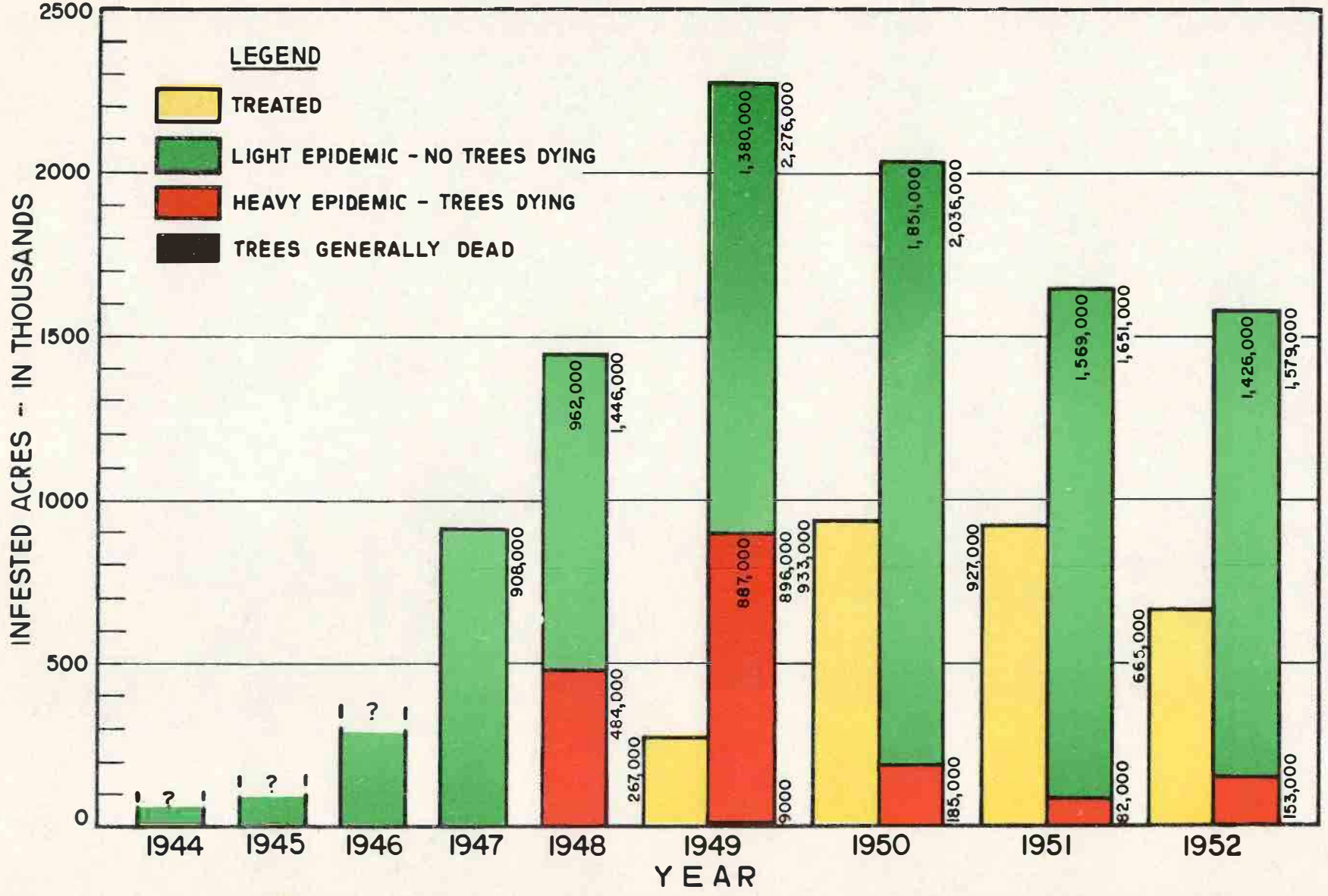
(6) Protection of valuable watersheds has been achieved and a potentially serious forest fire hazard has been averted.

(7) The practicability of aerial spraying to control the budworm has been demonstrated.

1/ Report of Forest Insect Surveys in Oregon and Washington, Season of 1952. Compiled by Oregon State Board of Forestry and Bureau of Entomology and Plant Quarantine. October 24, 1952.

GRAPH I

PROGRESS OF SPRUCE BUDWORM EPIDEMIC IN OREGON AND WASHINGTON



A digest of the four completed control projects shows the following highlights:

Year	Acreage Treated	Average Cost Per Acre	Percent of Budworm Mortality Range	Average
1949	267,000	$1.20	88.9-100	97
1950	933,000	$1.06	90.4-100	99
1951	927,000	$1.06	74.0-100	98
1952	665,000	$1.04	81.8-100	98
	2,792,000			

The spraying has held the line so far. The Committee had hoped that by now natural control would have taken over. Unfortunately, this development, which is bound to occur, has not yet become evident on most areas. In fact there have been some reverses, as follows:

(1) New centers of epidemic infestation have developed on the Willamette, Malheur, Whitman, and Wallowa National Forests in Oregon, and on the Wenatchee National Forest in Washington.

(2) The budworm has reinfested small acreages on the following previously sprayed areas: Browder Creek, Smith River and Carpenter Mountain on the Willamette National Forest, and the Tucannon River and Wolf Creek drainages on the Umatilla National Forest.

(3) Throughout most of the Blue Mountains area, in both Oregon and Washington, there has been a marked enlargement and intensification of the unsprayed centers of epidemic infestation.

(4) The acreage of heavy epidemic infestation increased from 82,000 acres in 1951 to 153,000 acres in 1952.

(5) A virulent and widespread epidemic of the Douglas-fir beetle has developed both on sprayed and unsprayed areas in the Blue Mountains of Oregon and Washington and is killing great numbers of trees weakened by the budworm.

In 1952, epidemic infestations of the budworm were found on 1,578,640 acres, with 376,400 acres (23.8%) light, 1,048,960 acres (66.5%) moderate and 153,280 acres (9.7%) heavy. (In Table 1 of the present control plan "light epidemic" infestation includes the "light" and "moderate" classes listed in the survey report of October 24, 1952. The "heavy" classes are the same.)

The acreage of spruce budworm epidemic infestations existing in 1952, as recorded by the survey and compared to the conditions in 1951, is as follows:

Area	1952	1951
Blue Mountains, Oregon	1,407,680 Acres	1,329,480 Acres
Blue Mountains, Washington	127,280 "	182,880 "
Western Oregon	23,840 "	56,960 "
Eastern Washington Cascades	19,840 "	3,840 "
Eastern Oregon Cascades	0 "	77,440 "
Area Totals	1,578,640 Acres	1,650,600 Acres
Total for Oregon	1,431,520 Acres	1,463,880 Acres
Total for Washington	147,120 "	186,720 "
State Totals	1,578,640 Acres	1,650,600 Acres

RECOMMENDATIONS FOR 1953

Two developments in 1952 seriously complicated the Committee's task of making recommendations for budworm control in 1953. First--a virulent and widespread outbreak of the Douglas-fir beetle has developed on both the treated and untreated areas in the Blue Mountains area of both States. On areas suffering heavy losses from the beetle, control of that insect is essential before making further heavy expenditures for budworm control. On areas not yet severely attacked by the beetle, it may be desirable to spray sooner than heretofore to control the budworm and to reduce losses caused by the beetle. Second--a strong upswing of budworm populations in untreated areas raises the question of how long direct control measures will be necessary against this defoliator.

After taking all the factors into account, the Committee recommends the spraying of 544,840 acres of budworm infestation in Oregon in 1953. No budworm control is recommended in Washington in 1953. No direct control of the Douglas-fir beetle seems practical at this time, but the Committee recommends that salvage of the beetle-infested trees be speeded.

Units to be Treated in 1953

In preparing plans for budworm control in 1953, the Committee gave priority to:

(1) All epidemic infestations in western Oregon.

(2) Heavy epidemic infestations in the Blue Mountains of Oregon having sufficient timber values to warrant control expenditures and not complicated by the current Douglas-fir beetle epidemic.

(3) Epidemic infestations in the Blue Mountains of Oregon, which, if left untreated for another year, might seriously reinfest adjacent units already brought under control.

The proposed 1953 control plan includes 7 of the 23 infestation units recorded during the 1952 survey (Table 1). Present budworm conditions on these seven units are discussed in the section of this plan entitled "Control Unit Data". Table 2 presents the ownership pattern on the units proposed for treatment. A brief summary of these ownerships is as follows:

Federal and Indian	437,587 acres	(80.3%)
Private	105,710 "	(19.4%)
State and County	1,543 "	(0.3%)
	544,840 acres	(100.0%)

Apportionment of Costs

It is proposed that the costs of control in 1953 be apportioned by the formula used in 1952. On this basis the costs will be divided as follows:

1. Federal Government:
   (a) To pay the full cost of treating lands under federal jurisdiction: National Forest, Public Domain, Indian and Tribal, etc.
   (b) To contribute 25 percent of the cost of treating privately-owned lands.

2. State of Oregon:
   (a) To pay the full cost of treating State, County and municipally-owned lands.
   (b) To contribute 37½ percent of the cost of treating privately-owned lands.

3. Private Owners:
   (a) To pay 37½ percent of the cost of treating privately-owned lands within the zones of infestation established by the State Forester.

Using an estimated cost of $1.10 per acre, the probable obligations for the 1953 project (Table 3) are as follows:

Federal	
For federal lands	$481,346
For private lands	29,070
Total federal funds required	$510,416
State of Oregon	
For state, county, municipal lands	$ 1,697
For private lands	43,604
Total State of Oregon funds required	$45,301
Private Owners	
For private lands in Oregon	$43,604
TOTAL COST OF 1953 PROJECT	$599,321

Project Administration.

During the previous four large-scale control projects from 1949-1952, a satisfactory and practical system of project administration and technical supervision has been developed. The Committee recommends that the 1953 project be conducted in a similar manner as follows:

(1) That the Bureau of Entomology and Plant Quarantine again be responsible for the supervision, coordination and inspection of all technical phases of the project.

(2) That the administrative responsibilities again be divided between the U. S. Forest Service and the Oregon State Board of Forestry as shown in Table 4 and summarized below:

Agency	Total Acres	Percent of Total Ownership		
		Federal	Private	State, County
Oregon State Board of Forestry	276,000	88.0	11.7	0.3
U. S. Forest Service	268,840	72.4	27.3	0.3
Total	544,840	80.3	19.4	0.3

The Committee again urges the administrative agencies to continue to keep control costs at the lowest possible level compatible with effective and safe control.

Research

Adequate research prior to and in conjunction with a costly control program of this nature is of paramount importance. Satisfactory progress has been made in developing and improving the operational phases of the program through research. Comparatively less emphasis has been given to the entomological phases of this program. Detailed investigations were started in 1950 to gather data on the life history of the budworm, the factors influencing natural control, and the rate of reinfestation of treated areas. A continued and expanded biological research program is urgently needed and is strongly recommended by the Committee. The Committee also recommends that the studies to improve the effectiveness of control, to reduce costs, and to increase safety be continued.

CONTROL UNIT DATA

Seven control units are recommended by the Committee for treatment in 1953. The are discussed below and are shown on the attached map. Tables 1-4 present the degree of infestation, acreages, ownerships, spraying costs, and administration of the proposed project. The numbers and names of the units are the same as those given in the 1952 survey report.

Western Oregon Area

Epidemic infestations of the spruce budworm in western Oregon are at their lowest level in five years. Four small centers of infestation, totalling 23,840 acres on the Willamette National Forest were recorded in 1952. It is evident that the control strategy of blocking out and treating all centers of recognizable infestation has prevented tree-killing by the budworm and has greatly reduced the spread of the outbreak in this important timber producing area. A summary of the control work to date is as follows:

Year	Acreage Treated
1949	160,234
1950	119,730
1951	161,919
1952	78,573
Total	520,456

It is the opinion of the Committee that the control work conducted in this area has been fully justified and that the policy should be continued. Therefore, all known centers of epidemic infestation, plus a suitable buffer zone, should be treated in 1953. It is recommended that the U. S. Forest Service administer the 1953 project in this area.

(1) Santiam Unit: The Santiam Unit, located in the upper drainages of the North and South Santiam Rivers and just north of the boundary of the unit treated in 1951, is the largest block of infested timber recorded in western Oregon in 1952. It is proposed to treat 48,360 acres (98.4 percent in federal ownership) of which 11,520 acres are epidemic infestations and 36,840 acres are buffer zones. The latter is essential to block out this infestation to a recognizable spray boundary and to encompass the area of probable spread.

(2) Browder Creek Unit: Two small centers of light epidemic infestation, totalling 5,920 acres, plus a buffer zone of 1,760 acres, making a total of 7,680 acres in the Browder Creek and Smith River drainages are recommended for treatment in 1953. The entire unit is in federal ownership. Both of these centers were treated in 1951, and have since become partially reinfested.

(3) Carpenter Mountain Unit: One center of light epidemic infestation of 2,720 acres plus a buffer zone of 1,600 acres, making a total of 4,320 acres, southeast of Carpenter Mountain in the Smith River drainage is recommended for treatment in 1953. The ownership is entirely Federal. This small center of infestation is on a block that was treated in 1951 and has since become reinfested.

(4) Mink Lake Unit: One center of heavy epidemic infestation near Mink Lake, in the Elk Creek drainage, of 3,680 acres, plus a buffer zone of 4,960 acres, making a total of 8,640 acres, is recommended for treatment in 1953. The ownership is entirely Federal.

Timber values within and adjacent to these four units are very high. The stands will average about 40,000 board feet per acre and, at a conservative figure of $15.00 per thousand board feet, the stumpage value of the timber alone is over $41,000,000. Because of these and even higher values in the surrounding stands threatened by this outbreak, control on the western Oregon area is placed at the head of the list for 1953.

Blue Mountains-Oregon Area

Since the start of the present spruce budworm epidemic in 1944, the Blue Mountains-Oregon area has consistently harboured the largest acreage of epidemic infestations. In 1952 some 1,407,680 acres in this area were found to be so infested. This is an increase of 78,200 acres over that recorded in 1951. A summary of the control work in this area is as follows:

Year	Acreage
1950	747,781
1951	479,164
1952	371,511
Total	1,598,456

The Committee's policy for spruce budworm control in the Blue Mountains-Oregon area has been to withhold treatment until extensive tree killing by the budworm was in progress or imminent within one year. The first project in this area was conducted in 1950. This and subsequent projects have satisfactorily controlled the budworm on the critical units; however, epidemic populations of the budworm have continued to develop over most of the untreated units. At the present time, the extensive Douglas-fir beetle outbreak has seriously complicated the budworm control strategy for this area.

The Committee feels that its control policy is sound but, in view of the beetle problem, it may be necessary to institute control sooner than heretofore. A total of 475,840 acres of epidemic infestation in the Blue Mountains-Oregon area is recommended for control in 1953. This infestation is in three control units, with 411,360 acres of light and 64,480 acres of heavy infestation. The ownership is 77.6 percent federal, 22.1 percent private, and 0.3 percent state or county.

The stumpage value of the infested timber is nearly $10,000,000 on the basis of stands containing an average of 5,000 board feet per acre and a conservative value of $4.00 per thousand board feet.

It is recommended that the Malheur Unit be administered by the U. S. Forest Service and that the Dale and Starkey Units be administered by the Oregon State Board of Forestry.

(7) Malheur Unit: The spruce budworm infestation, which has been on the Long Creek District of the Malheur National Forest for several years, was found to have increased in size and intensity in 1952. It has now reached the stage where control measures are needed. As yet there are no unusual concentrations of bark beetles on or near this unit. The Committee strongly recommends the inclusion of this unit in the 1953 control plan. It is proposed to treat 199,840 acres; of which 154,240 are light and 45,600 are heavy infestations. The ownership is approximately 64 percent public and 36 percent private.

(9) Dale Unit: Epidemic infestations of the spruce budworm were recorded on 41,280 acres in the North Fork of the John Day River drainage of the Whitman National Forest in 1952. This sizeable infestation is adjacent to the large Ukiah Unit treated in 1950. Because of this and the fact that the infestation has now reached the level where control is needed to prevent extensive killing of timber, the Committee recommends treatment of this unit in 1953. There are 32,800 acres of light and 8,480 acres of heavy infestation, with 95.3 percent in federal ownership to be treated.

(10) Starkey Unit: The Starkey Unit lies between the Meacham and Ukiah Units that were treated in 1951. It consists of 234,720 acres of epidemic infestation of which 224,320 acres are light and 10,400 acres are heavy infestation. The ownership is 82.4 percent national forest, 4.3 percent Indian, 13.0 percent private and 0.3 percent State. Three facts prompted the Committee to recommend the treatment of this unit in 1953: (a) The present infestation is about 20,000 acres larger than in 1951 and contains 4 percent heavy epidemic infestation which was absent in 1951, (b) repeated budworm defoliations are gradually weakening the trees and, while there is no abnormal killing by the Douglas-fir beetle, the threat of losses from this source is high, and (c) if left untreated for another year, the unit poses a real threat of reinfesting the two previously treated units.

Units Excluded from Control in 1953

Each of the units recorded as infested during the 1952 survey was considered by the Committee and the arguments for and against control were carefully weighed. The following units are omitted from the present plan for the reasons given:

(1) Units Excluded by Reason of the Douglas-fir Beetle Problem: The Troy and Saddle Mountain Units, containing 143,200 acres of epidemic infestation (98% in federal ownership), are excluded because a severe outbreak of the Douglas-fir beetle is killing budworm-weakened trees. Solution of this beetle problem is necessary before making further expenditures for budworm control.

(2) Units Excluded by Reason of Generally Low Timber Values: The Chesnimnus, Joseph, and Snake Units contain 400,000 acres of epidemic infestation of which 94% is in federal ownership. Considerable killing in 1953 is expected on the 15 percent of the total area classified as heavy epidemic. The Committee feels that the commercial timber values are too low to warrant treatment, and therefore recommends against control on these units.

(3) Units Excluded by Reason of Operational Problems: The Eagle Creek and Wenatchee Units contain 66,240 acres of epidemic infestation (90% in federal ownership), most of which is in extremely rough terrain. The hazards and difficulties of spraying such stands and the unsatisfactory control obtained during past projects under similar conditions are the primary reasons for excluding these units from the 1953 plans.

(4) Units Excluded by Reason of Low Intensity Infestation: The Aldrich Mountain, La Grande, Moss Spring, Ochoco, Powder River, Susanville, Tucannon, Whiskey Creek and Wolf Creek Units contain 469,520 acres of epidemic infestation (79% in federal ownership). These units are excluded because the current budworm infestations are generally well below tree-killing intensities and no tree mortality is expected in the near future. The Tucannon and Wolf Creek Units are portions of previously treated units that have, for some unexplained reason, become reinfested. The La Grande, Moss Spring and Whiskey Creek units are adjacent to previously sprayed units. Each of these last five units nearly meet the prerequisites for control and each was seriously considered by the Committee; however, control has been postponed for the reasons given.

TABLE 1 - SUMMARY OF 1952 SPRUCE BUDWORM EPIDEMIC IN OREGON AND WASHINGTON

AREAS AND UNITS	Infested Acreage: Light Epidemic (Acres)	Heavy Epidemic (Acres)	Buffer Zone (Acres)	Total (Acres)	Spraying Schedule: 1953 (Acres)	Residue (Acres)
Western Oregon						
(1) Santiam	7,680	3,840	36,840	48,360	48,360	
(2) Browder Creek	5,920		1,760	7,680	7,680	
(3) Carpenter Mt.	2,720		1,600	4,320	4,320	
(4) Mink Lake		3,680	4,960	8,640	8,640	
Total	16,320	7,520	45,160	69,000	69,000	
Blue Mountains-Oregon						
(5) Ochoco	273,280			273,280		273,280
(6) Aldrich	5,120			5,120		5,120
(7) Malheur	154,240	45,600		199,840	199,840	
(8) Susanville	24,800			24,800		24,800
(9) Dale	32,800	8,480		41,280	41,280	
(10) Starkey	224,320	10,400		234,720	234,720	
(11) La Grande	84,320			84,320		84,320
(12) Powder River	31,200			31,200		31,200
(13) Eagle Creek	44,960	1,440		46,400		46,400
(14) Moss Spring	26,880			26,880		26,880
(15) Joseph	109,440	5,440		114,880		114,880
(16) Snake	171,360	20,640		192,000		192,000
(17) Chesnimnus	60,320	32,800		93,120		93,120
(18) Whiskey Creek	15,520			15,520		15,520
(19) Troy	22,240	2,080		24,320		24,320
Total	1,280,800	126,880		1,407,680	475,840	931,840
TOTAL FOR OREGON	1,297,120	134,400	45,160	1,476,680	544,840	931,840
Blue Mountains-Washington						
(20) Saddle Mt.	106,400	12,480		118,880		118,880
(21) Tucannon	4,880			4,880		4,880
(22) Wolf Creek	3,520			3,520		3,520
Total	114,800	12,480		127,280		127,280
Eastern Washington Cascades						
(23) Wenatchee	13,440	6,400		19,840		19,840
TOTAL FOR WASH.	128,240	18,880		147,120		147,120
GRAND TOTAL	1,425,360	153,280	45,160	1,623,800	544,840	1,078,960

TABLE 2 - PROPOSED 1953 SPRUCE BUDWORM CONTROL PROJECT BY OWNERSHIPS

Areas and Control Units	FEDERAL					STATE & COUNTY		PRIVATE		GRAND TOTAL
	National Forest (Acres)	Public Domain (Acres)	Indian and Tribal (Acres)	Total (Acres)	Percent of Total	(Acres)	Percent of Total	(Acres)	Percent of Total	(Acres)
WESTERN OREGON										
(1) Santiam	47,590			47,590	98.4			770	1.6	48,360
(2) Browder Creek	7,680			7,680	100.0					7,680
(3) Carpenter Mt.	4,320			4,320	100.0					4,320
(4) Mink Lake	8,640			8,640	100.0					8,640
Total	68,230			68,230	98.9			770	1.1	69,000
BLUE MOUNTAINS - OREGON										
(7) Malheur	115,647	10,832		126,479	63.3	800	0.4	72,561	36.3	199,840
(9) Dale	39,339			39,339	95.3			1,941	4.7	41,280
(10) Starkey	193,145	271	10,123	203,539	86.7	743	0.3	30,438	13.0	234,720
Total	348,131	11,103	10,123	369,357	77.6	1,543	0.3	104,940	22.1	475,840
GRAND TOTAL	416,361	11,103	10,123	437,587	80.3	1,543	0.3	105,710	19.4	544,840

TABLE 3 - PROPOSED APPORTIONMENT OF COSTS FOR 1953 SPRUCE BUDWORM CONTROL PROJECT
(Based on estimated cost of $1.10 per acre)

AREAS AND CONTROL UNITS	FEDERAL COSTS			STATE COSTS			PRIVATE COSTS	GRAND TOTAL
	For U.S. Lands (100%)	For Private Lands (25%)	Total	For State & County Lands (100%)	For Private Lands (37½%)	Total	For Private Lands (37½%)	
WESTERN OREGON								
(1) Santiam	$ 52,349	$ 212	$ 52,561		$ 317	$ 317	$ 317	$ 53,195
(2) Browder Creek	8,448		8,448					8,448
(3) Carpenter Mt.	4,752		4,752					4,752
(4) Mink Lake	9,504		9,504					9,504
Total	$ 75,053	$ 212	$ 75,265		$ 317	$ 317	$ 317	$ 75,899
BLUE MOUNTAINS - OREGON								
(7) Malheur	$ 139,127	$ 19,954	$159,081	$ 880	$ 29,931	$ 30,811	$ 29,931	$ 219,823
(9) Dale	43,273	534	43,807		800	800	800	45,407
(10) Starkey	223,893	8,370	232,263	817	12,556	13,373	12,556	258,192
Total	$ 406,293	$ 28,858	$435,151	$1,697	$ 43,287	$44,984	$ 43,287	$ 523,422
GRAND TOTAL	$ 481,346	$ 29,070	$510,416	$1,697	$ 43,604	$45,301	$ 43,604	$ 599,321

TABLE 4 - PROPOSED ADMINISTRATION OF 1953 SPRUCE BUDWORM CONTROL PROJECT

ADMINISTRATIVE AGENCY	CONTROL UNITS	FEDERAL ACREAGE	PERCENT OF TOTAL	STATE AND COUNTY ACREAGE	PERCENT OF TOTAL	PRIVATE ACREAGE	PERCENT OF TOTAL	TOTAL ACREAGE
U.S. Forest Service	(1) Santiam	47,590	98.4			770	1.6	48,360
" "	(2) Browder Creek	7,680	100.0					7,680
" "	(3) Carpenter Mt.	4,320	100.0					4,320
" "	(4) Mink Lake	8,640	100.0					8,640
" "	(7) Malheur	126,479	63.3	800	0.4	72,561	36.3	199,840
	TOTAL ACRES	194,709	72.4	800	0.3	73,331	27.3	268,840
Oregon State Board of Forestry	(9) Dale	39,339	95.3			1,941	4.7	41,280
"	(10) Starkey	203,539	86.7	743	0.3	30,438	13.0	234,720
	TOTAL ACRES	242,878	88.0	743	0.3	32,379	11.7	276,000
GRAND TOTAL		437,587	80.3	1,543	0.3	105,710	19.4	544,840

SPRUCE BUDWORM SITUATION IN OREGON & WASHINGTON

CONTROL PROGRAM PROPOSED FOR 1953

LEGEND

	To be Controlled in 1953	544,840 Acres
	Infested - No Control in 1953	1,033,720 Acres
	Aerial Spraying Project of 1952	665,000 Acres
	Aerial Spraying Projects of 1949, 1950, 1951	2,128,000 Acres
(1) SANTIAM	Number and Name of Infestation Unit	
	Area Boundaries	

BASIS: Cooperative Aerial and Ground Survey
by OREGON STATE BOARD OF FORESTRY
and
U.S. BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
1952